Digital Signal Processing

Digital Signal Processing

Contents

1-Introduction

1) Introduction to Digital Signal Processing

- ◦ Review of background DSP
- ◦ Review of mathematical methods
- ◦ processes and linear systems

Digital Signal Processing

2) Multirate techniques and wavelets

◦ Introduction to short-time Fourier analysis
◦ Filter-banks and overlap-add methods of analysis and synthesis
◦ Introduction to generalised time-frequency representation
◦ Wavelet analysis
◦ Multirate signal processing
◦ Interpolation and decimation
◦ Efficient filter structures for interpolation and decimation

Digital Signal Processing

3) Classical spectrum estimation methods

◦ Power spectrum, power spectral density functions, random processes and linear systems
◦ Introduction to statistical estimation and estimators
◦ Biased and unbiased estimators
◦ Einstein/Wiener Khintchine Theorem
◦ Estimation of autocorrelations
◦ Means and variances of periodograms
◦ Smoothed spectral estimates, leakage

Digital Signal Processing & Digital Filters

4) Modern spectrum estimation methods

◦ Introduction to modern spectral estimation: Principles and approaches

◦ Cramer-Rao Lower Bound (CRLB) and Efficient estimators

◦ The Maximum Entropy Method (MEM) or Autoregressive Power Spectrum Estimation: Principles.

◦ The MEM equations and Levinson/Durbin algorithm

4) Modern spectrum estimation methods (continued)

◦ Introduction to Linear Prediction

◦ Linear Predictive Coding using co-variances and correlations

◦ Cholesky decomposition

◦ Lattice Filters

◦ Linear Prediction of Speech Signals

5) Adaptive signal processing

◦ Introduction to adaptive signal processing

◦ Objective measures of goodness

◦ Least squares and consequences

◦ Steepest descent

◦ The LMS and RLS algorithms

◦ Kalman Filters

Digital Signal Processing

6) Applications

- Communications
- Biomedical
- Seismic
- Audio/Music